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FYR 85-56

May 9, 1985

United States Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Mr. John A. Zwolinski, Chief
Operating Reactors Branch No. 5
Division of Licensing

References:
(a) License No. DPR-3 (Docket No. 50-29)
(b) USNRC Letter to all Licensees, dated February 1, 1984 (GL 84-04)
(c) YAEC Letter to USNRC, dated September 27, 1984 (FYR 84-99)
(d) WCAP 9558, Revision 2 (May 1981) "Mechanistic Fracture Evaluation of Reactor Coolant Pipe Containing a Postulated Circumferential Throughwall Crack"
(e) WCAP 9787 (May 1981) "Tensile and Toughness Properties of Primary Piping Weld Metal for Use in Mechanistic Fracture Evaluation"
(f) Letter Report NS-EPR-2519, E. P. Rahe to D. G. Eisenhut (November 10, 1981) Westinghouse Response to Questions and Comments Raised by Members of ACRS Subcommittee on Metal Components During the Westinghouse Presentation on September 25, 1981
(g) NUREG-0825, Integrated Plant Safety Assessment Systematic Evaluation Program - Yankee Nuclear Power Station

Subject: Generic Issue A-2, Elimination of Postulated Pipe Breaks

Dear Sir:

USNRC Generic Letter 84-04 [Reference (b)] provided the staff Safety Evaluation Report for analysis materials submitted for a group of utilities operating PWRs to resolve Generic Issue A-2. The staff evaluation concluded that, provided two conditions were met, an acceptable technical basis exists so that the asymmetric blowdown loads resulting from large breaks in main coolant loop piping need not be considered as a design basis for the sixteen domestic plants for which the analysis applies. The purpose of this letter is to respond to the open items identified in generic letter 84-04 to obtain final resolution to generic issue A-2.

The two conditions specified in generic letter 84-04, that must be met for staff approval concern verification of bending moment loads at two plants and verification of leak detection capability. Yankee is one of the two plants for which confirmation of maximum bending moments was required. This information was provided in Reference (c). The second condition, that leakage detection systems exist to detect postulated flaws utilizing guidance from Regulatory Guide 1.45, with the exception of seismic equipment qualification, is also applicable.

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Yankee has several leak detection systems with at least one that is capable of detecting a one gallon per minute leak in four hours. Conservative calculations of leakage from flaws shown to be stable in WCAP 9558 and WCAP 9787, indicate that leak flow rates one to two orders of magnitude greater than one gallon per minute can be expected if these flaws exist in reactor coolant piping [see Reference (f)]. The equipment provided for leak detection, the means of quantifying reactor coolant system leakage and leak detection operability requirements are delineated in Section 3.1.5 of the Yankee Technical Specifications. The Yankee leak detection capability has been evaluated against current regulatory criteria during Systematic Evaluation Program review of Topic V-5, Reactor Coolant Pressure Boundary (RCPB) Leakage Detection. Acceptance of our leak detection capability is documented in Reference (g). Because Yankee Technical Specifications require the operability of leak detection systems and because these systems, with margin, are capable of detecting leakage from postulated circumferential throughwall flaws, adequate leak detection capability exists to satisfy the staff condition of approval.

Even though the staff concluded that an acceptable technical basis had been provided, Mr. Eisenhut's February 1, 1984 letter also stated that authorization to remove or not to install protection against asymmetric dynamic loads in the primary coolant loop will require an exemption from General Design Criterion 4 (GDC-4). Yankee does not believe that an exemption is required because, among other things, Footnote 1 to Appendix A to 10 CFR Part 50 anticipated that further details relating to the type, size, and orientation of postulated breaks in specific components of the reactor coolant pressure boundary would be developed to define Loss of Coolant Accidents (LOCAs) postulated in plant design bases. Thus, the existing design criteria anticipated that, when developed, justification such as advanced fracture mechanics analyses could be used to define postulated LOCA pipe break sizes less than the double-ended rupture of the largest pipe. In addition, Appendix A sets forth requirements for design criteria that must be included in an application for a construction permit for a proposed facility pursuant to the provisions of 10 CRF 50.34. It has not been established that the application requirements apply to facilities which were already operating prior to the issuance of Appendix A. Nevertheless, since sufficient justification for an exemption has been presented and, for all intents and purposes, an exemption will have no effect on plant operation, Yankee requests that an exemption from GDC-4 be issued as set forth in the enclosed application. A fee of $150.00 is enclosed pursuant to 10 CFR 170.21.

We trust this information is satisfactory; however, if you have any questions or desire additional information, please contact us.

Very truly yours,
YANKEE ATOMIC ELECTRIC COMPANY

J. A. Kay

J. A. Kay
Senior Project Engineer - Licensing

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EXEMPTION APPLICATION
YANKEE ATOMIC ELECTRIC COMPANY
YANKEE NUCLEAR POWER STATION

In response to generic letter 84-04, "Safety Evaluation of Westinghouse Topical Reports Dealing With Elimination of Postulated Pipe Breaks in PWR Primary Main Loops", YAEC requests the elimination of large reactor coolant system primary loop pipe breaks from consideration in the structural design basis of the Yankee Nuclear Power Station. This request is based upon the use of advanced fracture mechanics technology as applied to primary system piping in Westinghouse Electric Corporation topical reports WCAP 9558, Revision 2 (proprietary) and WCAP 9787 (proprietary) and is the resolution of generic issue A-2, "Asymmetric Blowdown Loads on PWR Primary Systems".

The bases for the request are as follows:

1. Extensive operating experience has demonstrated the integrity of the PWR reactor coolant system primary loop including the fact that there has never been a leakage crack.

2. Pre-service, and in-service inspections performed on piping minimize the possibility of flaws existing in such piping. The application of advanced fracture mechanics has demonstrated that if such flaws exist they will not grow to a leakage crack when subjected to the worst case loading condition over the life of the plant.

3. If a large through-wall flaw is postulated, large margins against unstable crack extension exist for the stainless steel primary coolant piping even if subjected to the safe shutdown earthquake in combination with the loads associated with normal operation.

The application of advanced fracture mechanics technology has demonstrated that small flaws or leakage cracks (postulated or real) will remain stable and will be detected either by in-service inspection or by leakage monitoring systems long before such flaws can grow to critical sizes which otherwise could lead to large break areas such as the double-ended rupture of the largest pipe of the reactor coolant system. To date, use of this advanced fracture mechanics technology has been limited because of the definition of a LOCA in Appendix A to 10 CFR Part 50 so as to include postulated double-ended ruptures of piping regardless of the associated probability and regardless of the fact that there is no mechanistic scenario under which this event will occur. Application of the LOCA definition, without regard to this advanced fracture mechanics technology, to large diameter thick-walled piping such as the primary coolant pipes of a PWR imposes a severe penalty in terms of backfit cost and occupational radiation exposure. Massive pipe whip restraints which would be required without the fracture mechanics technology must be installed and then removed for in-service inspections. As documented in the NRC's Value-Impact Statement for Generic Issue A-2, this penalty is unreasonable because these pipes do not

have a history of failing or cracking and are conservatively designed. Accordingly, for design purposes associated with protection against dynamic effects, we request that postulated pipe breaks in the reactor coolant system primary loop be eliminated from the structural design bases where established by appropriate analysis. This request does not extend to specifying design bases for containment, the emergency core cooling system, or environmental effects.

The use of advanced fracture mechanics would permit a deterministic evaluation of the stability of postulated flaws or leakage cracks in piping as an alternative to the current mandate of overly conservative postulations of piping ruptures. This request is consistent with the provisions of Footnote 1 to 10 CFR Part 50, Appendix A, which contemplated the development of "further details relating to the type, size and orientation of postulated breaks in specific components of the reactor coolant pressure boundary".

As support for this request, in addition to the two Westinghouse topical reports referred to above, we request consideration of the following:

1. Memorandum from Darrell G. Eisenhut (NRC) to All Operating PWR Licensees, Construction Permit Holders and Applicants for Construction Permits dated February 1, 1984 - Subject: Safety Evaluation of Westinghouse Topical Reports Dealing with Elimination of Postulated Pipe Breaks in PWR Primary Main Loops (Generic Letter 84-04).

2. CRGR resolution of generic issue A-2, September 28, 1983.

3. ACRS letter dated June 14, 1983, re: "Fracture Mechanics Approach to Pipe Failure".

4. Memorandum from William J. Dircks, EDO, to ACRS dated July 29, 1983, re: "Fracture Mechanics Approach to Postulated Pipe Failure".

These documents and Westinghouse topical reports WCAP 9558 and WCAP 9787 provide a substantial and adequate basis for limiting postulated design basis flaws in stainless steel reactor coolant system piping.

A detailed value-impact analysis has been performed by Pacific Northwest Laboratory (PNL) to assess the relative costs of using advanced fracture mechanics techniques to justify design bases for several operating PWRs instead of modifying these plants to conform to piping restraint designs used in more recent plants. This analysis clearly establishes that the costs, both in dollars and radiation exposure, are greater for modifying the plants than are the money and radiation exposure costs due to guillotine pipe ruptures considering the low probability of such events. Yankee supports the conclusions reached in this analysis.

The analysis is not specific for each of the evaluated plants, but the analysis inputs are reasonable. Estimates of occupational radiation exposure rates, conservatively correspond with dose rates that are experienced at Yankee in locations where modifications would be required. Portions of the

estimates of modification costs and man-hours of occupational exposure are based on estimates from utilities with operating PWRs and thus should be realistic. It should be noted, however, that the cost estimates are no longer current and are, therefore, probably low. The estimates of guillotine pipe break frequency contained in the analysis are probably too high. The estimates are based on data which is not specific to guillotine breaks of large diameter, stainless steel, nuclear grade piping and, therefore, overestimates the probability of reactor coolant system double-ended pipe ruptures. All of these factors lead to the conclusions that the PNL analysis result is correct but that the analysis understates the relative value of using deterministic techniques to define design bases for the affected plants. The value-impact analysis clearly establishes that advanced fracture mechanics analysis is an acceptable alternative to designing and installing plant modifications to mitigate the consequences of unrealistically postulated double-ended guillotine breaks.

It is not clear that the use of advanced fracture mechanics is not already permitted by Appendix A to 10 CFR Part 50 to define LOCA pipe break sizes. Neither is it clear that 10 CFR 50.34 and Appendix A apply to plants already operating at the time these requirements for construction permit applications were issued. Nevertheless, Yankee Atomic Electric Company hereby applies, pursuant to 10 CFR 50.12(a), for an exemption from the provisions of 10 CFR 50 Appendix A authorizing alternative pipe break analyses to establish the structural design bases resulting from pipe breaks in connection with License No. DPR-3. Further, pursuant to 10 CFR 50.12(a), we believe the requested exemption will not endanger life or property or the common defense and security and is in the public interest.